Description

There is a variety of electrically and electronically regulated heating elements, which are maintained by means of temperature sensors (thermoelements, NTC-PTC-sensors etc.), according to pre-selected temperature adjustment, at a constant temperature. However, these temperature sensors show disadvantages as to e.g. linearity, temperature sensitivity, equalizing etc.

In the Patent Specification DE 3228202 a method is mentioned, which can already get by without a sensor. However, this arrangement has the disadvantage that in the heating circuit an additional measuring resistor is required in order to measure the current flowing through the heating element. Furthermore, this heating resistor is a source of errors, which is eliminated with this method.

With the method applied for here this disadvantage is avoided, so that this arrangement is not identical with the above-mentioned patent.

The patent applied for here completely renounces sensor or heating resistor. The heating element itself turns into a sensor.

The complete circuit arrangement solely consists of:

A. Heating element
B. alternating voltage switch
C. control loop with
    a. voltage stabilisation
    b. sequence control
    c. comparator
    d. control for the alternating voltage switch.

Description of the arrangement according to figure 1:

Direct voltage supply of the control circuit is provided from the alternating voltage by means of voltage stabilisation (1). The resistor of heating element (6) as well as the resistor of target value presetting (4) are subjected to a direct voltage. Comparator (2) compares the voltage drop over heating element (6) with the voltage drop over the resistor of target value presetting (4). If the heating element e. g. shows PTC-behaviour (ceramic heating element), it has to be heated in order to obtain a higher resistance value. When, then, e.g. the resistance value at target value presetting (4) is raised, this is reported by comparator (2) to control (3) for alternating voltage switch (5), after which alternating voltage switch (5) switches on and connects heating element (6) with the alternating voltage, after which the heating element starts heating.

The alternating voltage at heating element (6), however, immediately makes comparator (2) tilting, after which the latter opens switch (5) via control (3) and interrupts the heating process.

When the resistance value of heating element (6) still is below the target value presetting (4), comparator (2) immediately restarts the alternating voltage via (3) and (5).

Rapid restarting and interruption is repeated until the resistance of heating element (6) has reached the target value presetting (4), because then the voltage drop at the heating element (6), in case of alternating voltage as well as in case of switched off alternating voltage, is larger than the voltage drop at target value presetting (4).

When the heating element (6) cools down again and the voltage drop of the direct current decreases with dropping resistance, the heating process is again restarted when dropping below the target value presetting, until the target value presetting is once more reached.

By means of this regulating process a constant temperature at the heating element is achieved, which alternates by approximately ± 1%.

In the present embodiment, components (1), (2) and (3), which can also consist of single construction elements, are, due to cost and room saving reasons, taken from a highly integrated circuit (IC), which carries out the requested function by means of a corresponding circuitry. This enables the realisation on a conductor board, which has a size of only a few square centimetres, which can also be executed in SMD-technique, as the regulation only has a low power input.

As the temperature variation of the described arrangement is to high for certain ranges of application (e.g. in case of soldering devices for SMD-technique with conductor breadths of 0,xmm), an improved temperature stability can be obtained by means of greater efforts, while maintaining the measuring method.

This is achieved by expanding the regulation to an analogue/digital circuit with a pulse generator.

A correspondingly expanded arrangement is shown in figure 2.

By means of rectification (1) the alternating voltage turns into a pulsating direct voltage, which is smoothed and stabilised in voltage stabilisation (2). The pulse generator (3) provides a time partition of measuring phase and heating phase. In the measuring phase, heating is interrupted and the resistance of heating element (8) is compared in the comparator (5) with the target value presetting (4). Depending on, whether the resistance of the heating element is above or below the target value presetting, control (6) for alternating voltage switch (7) is informed, whether heating is required or not, in order to reach the target value. Heating is then continued during the heating phase until the next measuring phase takes place again. The pulse frequency is selected at a correspondingly high level, in order to obtain a temperature stability which is as high as possible.

This method can also be carried out by means of a computer.